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PHYSICOCHEMICAL ATTRIBUTES OF SOIL OF DIFFERENT SITES OF REWA REGION

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ABSTRACT

The importance of medicinal properties of many plants and their great bio-molecule role has already been established. According to one estimate around 70,000 plant species have been reported used at one time or another for medicinal purposes. Among various plants the herbs provide the basic platform material for the isolation and synthesis of conventional drugs. In Ayurveda about 2000 plant species are considered to have medicinal value while the Chinese pharmacopoeia list contain 5700 plant origin traditional medicines. Ancient Indian material Medica described number of plants and their contribution to the development of earliest usable phytotherapy on in Indian system medicines. The Charak Sanhita (1000 BC) contained the use of over 340 drugs belong to plants origin. Most of these plants gathered from wild habitat to isolate the drug for meet out the demand of the society. Thus, despite the rich heritage of knowledge on the use of plant drugs, little attention has been given for promotion of phytopathy.

KEYWORDS: Medicinal Properties, Bio-molecule, Conventional Drugs, Ayurveda, Chinese Pharmacopoeia & Phytopathy

INTRODUCTION

Soil is weathered surficial crust of rocks which support the different types of plant species and soil inhabiting micro-organisms. These micro-organism play important role for maintain the elemental cycle consequently, fertility status of the soil is maintained *(Daubenmire 1947).* In other word soil is product of many complex factors of nature such as rocks, climate, topography, plants, animals and age of the lands. Some scientist believes that soil is by product of complex material from four important components such as soil minerals, organic matter, soil water and soil atmosphere. These important factors of nature play vital role to enhance soil properties and enable to support biological system of the habitat *(Kramer 1944). Thurmann (1949)* noted great influence of physical properties as compare to that of chemical properties in the growth of plant. *Cole (1949)* noted the role of soil solution on vegetation growth while *Dastur & Saxton (1920,22)* recorded different growth of vegetation due to difference in edaphic environment. Pearsall work was quite important for the distribution of seeding and ground flora in England in relation to soil properties. *Watanable & Olsen (1962)* recorded nutrient availability at various pH. *Kramer (1944)* noted moisture availability of plants in different soil while *Puri (1960)* recorded succession of vegetation on different types of soil. *Rama krishnan (1960)* noted environmentally induced variation in different plant species. The role of physical properties of soil in vegetational growth recorded by so many earlier workers *(Abrol et. al. 1978; Sandhu et. al. 1981).* The forest soil are usually characterised by presence of high organic matter & nitrogen content prefer to support dense stand of vegetational growth *(Absol & Bhumbla 1978; Roy*

1992). The various aspect of soil, water and plant relationship such as water availability in soil in relation to soil moisture stress have been noted by *Coleman & Bodman (1945) & Black (1968).*

MATERIAL & METHODS

Climate Data

Month-wise climatic datas were noted such as minimum and maximum temperature, minimum and maximum relative humidity, rainfall Kuthulia office, Rewa. Average were calculated on the basis of data obtained.

Biometrical

After detail survey of many sites, four sites were selected for present investigation

Phytosociological Studies

In the present study qualitative characteristics such as frequency, density and abundance were estimated from the sites selected and using random method of sampling size of m^2 was used at 10 different places of each site. At each quadrat present species were noted and total number of individuals of each species were calculated. Then the average for each site was calculated and mentioned in the Table 4.1.

Frequency classes of associated were assigned as per methods suggested by *Misra & Puri (1954)*, and *Pandeya (1969)* frequency classes in relation to percentage of frequency is given below.

Frequency Class	Frequency %
A	0-20
B	21-40
C	41-60
D	61-80
E	81-100

Standard methods and laboratories have been used for analysis of relevant parameters for nutracidal value of plants as well as for their parts.

Vegetation study site were analysed quantitatively by using quadrat method. The 01×01 M. size of quadrat was used as a unit of sampling of vegetation. Sampling was done by laying randomly 10 quadrat during the mid winter season. The presence and absence of each species in each quadrat was recorded. The basal area of the species was determined by measuring the diameter at the pointing of emergence for annuals while on one meter height for perennial. The formula for calculating frequency, density, abundance, basal area relative frequency relative density, relative dominance of each species determined with the help of following formula.

$$\text{Frequency (\%)} = \frac{\text{Number of quadrats in which a species occurred}}{\text{Total numbers of quadrats sampled}} \times 100$$

$$\text{Density} = \frac{\text{Total number of individuals of species in all quadrats}}{\text{Total number of quadrat sampled}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occurred}}$$

Basal Area = πr^2

$\pi = 3.14$

r = radius of stem at the point of emergence.

Importance Value Index of each species was calculated by summing the percentage value of relative frequency, relative density and relative dominance expressed in per 300.

Relative frequency(%) =	Number of occurrence of species / Number of occurrence of all species	×100

Relative Density(%) =	Number of individuals of species in all quadrats / Number of individuals of all species in all quadrat	×100

Relative dominance (%)=	Total Basal cover of a species in all quadrats / Total basal cover of all species in all quadrats	×100

Importance Value Index (IVI)	=	% Relative frequency	+	% Relative density	+	% Relative dominance

Composite Soil samples were collected from 4 different sites in middle of winter season. The first weak of the month was used for soil collection. The physical chemical characteristics were analysed by using standard methods as suggested by earlier workers referred in the text. Soil sampling was done by using wooden stakes and metal wire, 10 quadrat each of a square meter were laid randomly. Composite soil samples, each comprising ten sub samples taken from these quadrats up to 20 cm depth. composite soil samples were collected. Soil sampling was done systematically in the first week of month round the year from all four sites. After collection, the samples were brought to the laboratory after crushing & mixing, the soil sample were passed through a 2mm sieves and then stored in labeled polythene bags. Samples of various wild medicinal plants and their parts including all parts were collected from different areas of Rewa region. Which are frequently grown in the area and used by poor as food & medicinal material. All samples were washed thoroughly to remove off impurities, and blotted dry. After cleaning and drying plants and their usable parts were separated into usable and non-usable portions taken into small portions and non usable parts were removed before oven drying the samples. Five samples for different usable parts of wild species were oven dried at 100°C till constant weight. The dried parts crushed, sieved & packed as fine powder for analysis. For the urgent analysis the fresh samples were used (e.g. Crude fat, acidity, vitamin C; TSS). Nutrient examinations were done within one month of the sample collection.

Various standard for analyses of plant material were used as given by *Moerman 1999, Leporatti 2003*. The quantitative analysis of the plant parts samples was broadly done for analysis technique. Primary analysis for organic groups of the plant samples, such as fats, carbohydrate, proteins, sugars fibers, Ash, Acidity, etc. were done as per standard methods. It accounts for most of the organic dry matter of the food & medicinal materials. The other analysis refers to the determination of' a particular element (Viz, N, P, K, La, Mg, Na, etc) or a compound present in the plant material. A brief analytical methods used as given below.

Analysis of Moisture, Fibers & Ash

Moisture in plant parts samples were determined by measuring loss in weight due to oven drying the plant samples till constant weight and calculating the difference between fresh weight and dry weight. Ash determination for

plant materials refers to the residue left after combustion of dried samples and is a measure of the total mineral content in the plant parts. It was estimated by using 25g of the powered plant samples in silica crucibles in a muffle furnace at 550°C for 3 hours. Crude fiber is essentially the residue left after sequential not digested with H_2SO_4 and NaOH. It mainly consists of cellulose together with a little lignin crude fiber was determined by acid and alkaline digestion methods using fibertec apparatus.

Determination of TSS, Acidity and Vitamin C

Total soluble solids (TSS) content of plant parts samples was done through hand refrectometer, which gives refractive index by placing a drop of usable parts, syrup on the prism and reading the corresponding value of substance by direct reading. Acidity of plant parts sap was determined by titrating a known weight of sample with 0.1 N NaOH using a few drops of 1% phenolphthalein solution as the indicator. The value calculated with reference to percent anhydrous citric acid. Fruits and vegetables are important source of ascorbic acid. The method used is based on the reduction of a dye (2, 6 - dichlorophenol) by ascorbic acid. The dye, which is blue in alkaline solution and red in acid solution, is reduced by ascorbic acid to a colorless form.

Determination of Chlorophyll and Anthocyanin

The colors of usable parts are very important as it is a primary determinant of the quality of the product. Chlorophyll and anthocyanin are frequently occurring as mixtures. Chlorophyll was determined by macerating plant sample in acetone in a pestle and mortal the filtered solution is tested for 00 in a spectrophotometer at 663 mm and 645nm, anthocyanins are fundamentally responsible for all the colour differences. It was determined by mixing usable parts with ethanolic HCl using a mortar and pestle. Filtered extract is kept for 24 hrs and OO' is taken at 535 nm using the spectrophotometer.

Determination of Fats and Proteins

Crude fat in plant samples was determined by exhaustively extracting a known weight of powered plant parts material with petroleum ether using soxhlet apparatus. The ether is evaporated and the residue weighted. The extracted crude. Fat of plant samples represents, besides the true fat (triglyceides), phospholipids, sterols, essential oils, and fat soluble pigments etc. protein was determined by microkjeldhal methods by multiplying nitrogen with 6.25. This is based on the assumption that plant proteins consist 16% of nitrogen.

Determination of Carbohydrates Sugars Cellulose Lignin

Carbohydrate content, other than sugars, for plant samples was obtained by the difference methods. The sum total of ash, acidity, crude fat, protein, sugars and crude fibers is subtracted from 100, represents primarily the carbohydrate content which also includes starch, protein, gums etc. the sugar content in the plant samples was estimated by determining the volume of unknown sugar solution required to completely reduce a measured volume of fehling's solution to red, insoluble curowsoxide. The reducing sugar in plant samples (Juice) was determined by mixing with lead acetate; kept overnight, mixed with potassium oxylate and titrated with fehling's solution A+B. For total sugar the overnight filtered juice of plant samples mixed with H_2SO_4, and again kept for another 24hrs thereafter neutralised with NaOH solution using phenolphthalein as an indicator. This solution is titrated with the fehling solution (A+B).

Acid detergent lignin (ADL) was determined using fibertec apparatus by de-fating a known weight of plant sample (w1) with acetone (cold extraction) and with acid detergent solution (hot extraction), and washed with hot water. The sample is mixed with H_2SO_4, for 3 hrs, again washed to free from acid. It is dried, weighted (w2) and ashed in muffle at 525°C for 3hrs. and again weighted (w3). The ADL is calculated as per following formula

$$\text{ADL (\%)} = \frac{W2 - W3}{W1} \times 100$$

Cellulose is determined by dezincification of plant samples, which yield the product consisting of cellulose plus various other polysaccharides, mainly hemi-cellulose. Cellulose was determined by difference of acid-detergent fiber minus acid detergent lignin. Hemicellulose was determined as the difference 0 neutral detergent fiber and acid detergent fiber using fibertec apparatus.

Determination of Minerals (Macro-Nutrients)

Nitrogen was determined through micro-kjeldahl method by digesting a known weight of plant sample and treating it with alkali.

The liberated ammonia is collected in boric acid and titrated with HCl. Phosphorus was estimated calorimetrically by treating the digested sample. With ammonium molybdate and freshly prepared ascorbic acid. Spectrophotometer apparatus was used to measure the absorbance at 880nm. Potassium and sodium was determined through flamephotometer. The flame excited atoms of potassium and sodium emit radiation at different specific wavelengths, which is measured using different filters. Calcium and magnesium in plant samples was determined by EDT A (The disodium salt of ethylene diamine - terta acetic - acid) tiration method.

Determination of Micro Nutrients

The micro-nutrients (Fe, Zn, Cu, Pb, Mn) were determined through atomic absorption spectrophotometer method. The plant samples were digested in tri-acid solution of HCI04. $HN0_3$ and H_2SO_4 were passed. Through atomic absorption spectrophotometer using different lumps and values were recorded, which further calibrated for different micro-nutrients.

RESULTS

Table 1: Physicochemical Attributes of Soil of Different Sites

Parameter	Site–I		Site–II		Site–III		Site–IV	
Colour	Brown		Brown		Yellow		Red Yellowish	
Type	Sandy loam		Sandy loam		Sandy Loam		Sandy Loam	
Ph	7.3	±0.003	7.6	±0.004	7.6	±0.003	7.3	±0.002
EC (mm hos/cm)	8.20	±0.004	8.10	±0.004	7.8	±0.003	7.6	±0.003
Organic Matter (%)	0.1870	±0.0001	0.1960	±0.0001	0.2342	±0.0001	0.2160	±0.0002
WHC (%)	52.40	±0.026	54.10	±0.021	55.25	±0.028	54.80	±0.027
Bulk density (g/cm^3)	1.52	±0.0006	1.48	±0.0005	1.52	±0.0006	1.50	±0.0007
AWC (%)	12.40	±0.006	13.65	±0.005	14.20	±0.006	13.85	±0.007
Infiltration Rate (cm/day)	1.32	±0.0005	1.45	±0.0006	1.68	±0.0006	1.72	±0.0007
N^+ (%)	0.240	±0.0001	0.218	±0.0001	0.210	±0.0001	0.206	±0.0001
P^+ (ppm)	9.2	±0.005	9.8	±0.006	10.30	±0.006	10.20	±0.007
K^+ (meq/L)	4.32	±0.002	5.30	±0.003	5.40	±0.002	5.35	±0.002

Table 1: Contd.,								
Ca^{++} (meq/L)	2.85	±0.001	3.10	±0.001	3.35	±0.002	3.40	±0.002
Mg^{++} (meq/L)	1.20	±0.0005	1.40	±0.0006	1.50	±0.0006	1.60	±0.0006
Na^{+} (meq/L)	104.32	±0.062	90.60	±0.046	87.60	±0.048	88.92	±0.051

DISCUSSIONS

All four sites shown sandy loam texture with Brown, Yellow & Red yellowish with slightly moderate pH. Site II^{nd} & III^{rd} shown pH value of 7.6 while I^{st} and IV^{th} shown slightly lower pH value i.e. 7.3. This is quite obvious that the huge amount of organic matter in the habitat restore the pH & nutrient availability of soil. The I^{st} Site shown maximum E.C. i.e. 8.20 mm hos/cm followed by 8.10 in Site–II^{nd} 7.8 in Site–III^{rd} and 7.6 in Site–IV^{th}. Maximum organic matter recorded in Site–III^{rd} i.e. 0.2342 followed by 0.2160 in Site–IV^{th} while Site I^{st} & II^{nd} shown slightly lesser amount of organic matter as compare to that of Site III^{rd} & IV^{th}. Site III^{rd} & IV^{th} shown maximum water holding capacity i.e. 55.25% for Site–III^{rd} & 54.80% for Site–IV^{th}. Better availability of water for good growth of vegetation is noted for all four sites.

Better infiltration rate recorded for Site–IV^{th} i.e. 1.72 cm/day followed by 1.68 cm/day for Site–III^{rd} slightly lesser infiltration value noted for Site–I^{st} & II^{nd}.

Higher percentage of nitrogen value was recorded for Site–I^{st} i.e. 0.240% followed by 0.218% for Site–II^{nd} comparatively lesser nitrogen values were recorded for Site–III^{rd} & IV^{th}. Maximum P content was recorded in Site–III^{rd} i.e. 10.30 ppm followed by 10.20 ppm in Site–IV^{th} while Site–II^{nd} shown 9.8 ppm and 9.2 ppm for Site–Ist. Maximum potassium content was recorded in Site III^{rd} i.e. 5.40 meq/l followed by 5.35 meq/e in Site IV^{th}. Little lesser value recorded for Site–II^{nd} i.e. 5.30 meq/l while Site–I^{st} shown less K^{+} value from region. Better divalent cat-ions noted for Site–III^{rd} & IV^{th} as compare to that of Site I^{st} & II^{nd}. Slightly higher amount of monovalent cat-ions Na^{+} is noted for Site–I^{st} & II^{nd}. The properties of all four sites support the luxuriant growth of vegetation of the habitat. The work results are in the agreement with the work of so many earlier workers *(Slayter 1967; Yadav et. al. 1972,75; Perez 1996; Witkowski & Connor 1996; Vera-Diaza et. al. 2008).*

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